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town, and on my arrival the mouse was in good condition. But the next morning it was again apparently dead; in the course of the day, however, being placed where it was warm, it gradually came back again to activity as before.

This mouse, then, when dug from the mound was in a state of the most profound lethargy,—if torpidity be too strong a term,—and it is safe to infer that it would have so remained till spring, had it not been removed into a warmer temperature; and this lethargy or torpidity was as intense, so far at least as regards external appearances, as that seen in other animals, not excepting reptiles and batrachians.

I may add that the observations above detailed show that this mouse is capable of passing into the deepest lethargic state in a single night, and of returning, when warmed, to activity again on the succeeding day.

The Jumping Mouse is very quiet in the daytime, but very active at night. When disturbed in its nest it vigorously repels the attack by striking with its fore feet with the greatest rapidity. It apparently does not seek to bite me.

Since the above was written the mouse has repeated the exhibitions detailed above, and at least once since the beginning of April. A colder night than usual seems to furnish the occasion for it to go into a state of the most profound lethargy.

THE WHITE COFFEE-LEAF MINER.

BY B. PICKMAN MANN.[*]

THE observations upon which I base the following history of that insect (*Cemiostoma coffeellum*) which is the greatest enemy to the coffee-culture of Brazil, were made in the autumn and winter of the year 1871, at the fazendas of São Sebastião and Secretario, in the township of Vassouras, Province of Rio de Janeiro, Brazil.

At São Sebastião, to whose owner, my esteemed friend Snr. Lindorf Moreira de Vasconcellos, I return my most heartfelt thanks for his unbounded hospitality and kindness, my observations extended through the greater part of the month of March.

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[*] A Report as Entomologist to the Government of Brazil.

At Secretario I continued my observations until the latter part of June, aided by the sympathy and coöperation of the proprietor, Dr. Christovão Corrêa e Castro, one of the most enlightened and progressive men whom I had the pleasure of knowing in Brazil.

The acknowledgment of my deep gratitude is due also to Col. Antonio Corrêa e Castro for his tender care of me during a month when I was prostrated by severe sickness.

I have arranged my account of the insect under headings, for greater convenience to the future investigator, and have added an explanation of the less familiar words used, for the benefit of those who are not acquainted with the science of entomology.

Food-plant, and Indications of the presence of the Insect.—The caterpillar (larva) lives in the leaves of the coffee-tree (*Coffea Arabica*), where the injury done by it is shown by the presence of rust-colored blotches on the upper surface of the leaf. These blotches are sometimes almost black in the centre.

After the larva has stopped feeding, and changed to a chrysalis (pupa), the slender, white chrysalis-case (cocoon) covered with its silken web may easily be found in a fold of the leaf.

The moths (imagos) whose beautifully ornamented, silvery wings hardly cover the breadth of the little finger nail, rest upon the leaves and branches of the tree when quiet, but are easily disturbed. Then they fly actively with a jerking flight.

Scientific Name.—The name of the genus (*Cemiostoma*) is derived from the Greek words *Κημός*, meaning *muzzle*, and *στόμα*, meaning *mouth*, so that it may be translated *muzzle-mouth*. This name was given by Zeller, in the year 1848 (in the "Linnæa Entomologica," vol. iii, p. 273), because the hairs on the side of the face are so long as to cover up the mouth. It should be accented on the antepenultimate syllable. Since it is neuter in gender, because *στόμα* is neuter, the specific name must be neuter also. The specific name is taken from the scientific name of the food-plant, with a termination indicating the small size of the insect.

Synonyme.—The insect was called *Elachista coffeella* by Guérin-Méneville in his memoir (to which I shall often refer hereafter), because at the time when he described it, the genus Cemiostoma had not been established, and the genus *Elachista* was still considered of such extent as to include this species.

It was referred to under the same name by Nietner in his pamphlet on the enemies of the coffee-tree in Ceylon.

Vernacular names. — Guérin-Mèneville, who described it as coming from the Antilles, called it "L'Elachiste du Cafier."*

In Brazil it is called "A Borboleta do Cafezal," the coffee-plantation butterfly or moth, but I should think it much more satisfactory to unite accuracy with definiteness by giving it the name of the White Coffee-leaf Miner, because other species of moths are found also living on the coffee-tree, and a black coffee-leaf miner (*Gracilaria? coffeifoliella*) is known in Ceylon.

Erroneous names.— This is probably the insect referred to doubtfully as a Bucculatrix (?) by Stainton in the "Entomologist's Weekly Intelligencer," vol. iv (1858), p. 70.

Imago.—The outspread wings of the perfect insect (imago) measure from tip to tip between four and six millimeters. The body is about two millimeters long. Silvery white scales cover the head and face, the body below, the upper side of the front wings, and the legs, except the tips of the first, second and fourth foot-joints (tarsi), upon the upper side of which the scales are black. In my specimens, which are not in good condition, the upper side of the hind-body (abdomen) is bare and of a yellowish brown color. The antennæ are smoky black, except at the base. The front wings are long in proportion to their breadth. On the upper side of each, at the extremity of the inner edge (inner angle) is a large steel-blue or black spot, which has a violet lustre. This spot is bordered on the sides towards the base and front edge of the wing by a golden-yellow band, which is continued toward the end of the wing. At more than half the distance from the base of the wing to the tip, arises from the front edge (costa) another golden-yellow band, with converging sides, bordered on each edge with black scales, which runs obliquely toward the black spot, and sometimes almost reaches the golden edging of that spot. Beyond an interval of about the width of this band nearer the tip of the wing (apex) arises another band of the same color, but wider and shorter, and bordered only on the inside with black scales. This band runs less obliquely toward the black spot, but does not meet the other bands. About as far beyond the second band as that is beyond the first, a line of black scales arises from the costa, and runs obliquely to a point at some distance beyond the black spot. Still nearer the end arises another line of black scales, which runs less obliquely, and meets the former at its termination, the two thus forming an acute angle. The inner and outer edges of the front wings, and the whole circumference of the hind wings bear long smoky-black or brown fringes. The hind wings are very narrow and pointed. They are smoky-black on both the upper and under sides.* The front wings are of the same color on the under side. From the front of the head projects a spreading tuft of silvery-white hairs. The scales behind this tuft lie smoothly back on the head. The antennæ are about three-fourths as long as the front wings, and thread-like. Their basal joints are thickly clothed with silvery hairs, which form a velvety eye-cap as large as the eyes. The eyes are black.

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*The effect upon the leaves was called "rouille" (rust), by the people of the country, who did not know to what it was due, and ascribed it to the action of the sun.

Pupa.— The chrysalis (pupa) is two millimeters long; of a yellowish brown color. The head is large; the eyes are black; the limbs are glued to the body; the last pair of legs extends very little beyond the tip of the abdomen. It appears to me that eight abdominal segments are visible.

Cocoon.— The cocoon is five millimeters long, slender, spindle-shaped, formed of threads of silk of a white color, which are laid lengthwise and close together upon the outside. It is open at each end with a longitudinal slit. It rests upon a flooring of silk, and is covered by a light web of white silk, which is spun across one of the furrows at the edge of a leaf. This web is a little broader at each end than in the middle, and has an opening in each end shaped like the point of a lance, through which openings the ends of the cocoon beneath may be seen.

Larva.—The caterpillar (larva) is four or five millimeters long, and seventy-five hundredths of a millimeter broad across the first ring (prothorax), which is the widest part. It is of a yellowish flesh color, partially transparent. It is flattened, and consists of twelve rings (segments) behind the head, between each of which the body is much constricted. The second and third segments (which, with the first, form the thorax,) are successively narrower than the segment in front of them; the next three segments are successively broader, and the rest of the segments (which, with the three before them, form the abdomen), are successively nar-

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* Guérin says (Mém. etc., p. 15) that they are covered with silvery scales like the superiors.

rower to the end. The head is flat, rounded in front, and is frequently much retracted within the prothorax, when its lobes show through the skin of the prothorax. The jaws (mandibles) have three teeth at the end,* and are covered in repose by the upper lip (labrum). The head on each side, has two eye-spots (ocelli), of which the anterior is the larger, and about nine hairs. The three segments of the thorax bear each a pair of jointed legs; the third, fourth, fifth, sixth and ninth or last segment of the abdomen bear each a pair of fleshy projections which serve as feet, so that the larva may be considered as sixteen-legged. From each side of the back of each abdominal segment, arise three hairs, of which the anterior or shortest is directed forward, while the two others are directed backward. The third hair is twice or more than twice as long as the second, being nearly equal in length to the breadth of the segment. The thoracic segments have all three hairs directed forward; the second hair is the longest, and an additional hair arises from the outer edge of the back of each segment.

The mine.— The habitation of the larva is a mine, which is made in the leaf by eating out the soft green substance (parenchyma) between the upper skin (epidermis) and the framework of the leaf, laying the framework bare, but leaving the epidermis intact, except at the point where (I suppose) the larva enters the leaf. At this point the wound heals up and forms a lenticular scar twenty-five hundredths of a millimeter in length, and fifteen hundredths of a millimeter in breadth, raised a little above the general surface of the leaf. The epidermis which covers the mine becomes rusty brown, sometimes almost black in the centre. The excrement (frass) adheres irregularly to its under surface. Sometimes a portion of the under surface of the leaf opposite the mine also turns brown.

When the eggs are laid in sets, as hereafter to be described, the mines of the separate larvæ usually become united, and even the mines of two sets may be united into one.

One mine fifteen millimeters long and ten millimeters broad, contained seven larvæ, the scars arranged in two groups of four and three respectively. Another scar was near.

As many as five mines, all inhabited, have been found on one leaf and even eight mines made by ten larvæ, though in this case some of the larvæ had escaped.

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* Guérin says (Mém. etc., p. 13) that they are bidentate.

When the larva escapes, it cuts an angular or rounded slit in the epidermis near an edge of the mine. This slit is slightly more than one millimeter across, about one and five-tenths millimeters long.

The eggs.— Before I had seen any of the insects, I was shown some eggs on a coffee-leaf, which were said to be the eggs of this moth. I was not able to describe them at the time, but I think they could not have belonged to this moth, because they seemed too large. Stainton says, however (Nat. Hist. Tin., i, 324), that the eggs of *C. scitellum*, which is in its habits one of the nearest allies of this species, are disproportionately large for the size of the insect. Guérin does not describe the eggs in his memoir.

Classification. — It belongs to the suborder of scaly-winged insects (Lepidoptera), which may be known from other winged insects because their wings are more or less covered with scales, which lap over each other like tiles on the roof of a house, and further they (in the imago state) have no visible jaws, but either have a tubular tongue formed of two similar pieces which can be rolled up like a watch-spring, or have no means of taking food.

It belongs to the tribe of cloth-worm moths (Tineina), which are all of small size, and may be known from the other Lepidoptera because their wings, which are elongated, are not split, but are fringed with long hairs.

According to Zeller (Linn. Entom., iii (1848), p. 250), the only Tineina whose larvæ make mines in leaves, and whose imagos have the head covered with entirely smooth scales, and have the lower joints of the antennæ widened into an eye-cap, are included in the genera Cemiostoma and Phyllocnistis. These genera with others, were considered by Stainton (I know not in what work) to form the family of Lyonetia moths (Lyonetidæ). The genus Cemiostoma, to which our insect belongs, is distinguished from the genus Phyllocnistis by the absence of tongue-shields (palpi) (l. c., p. 250), and by the middle area (cell) of the fore wings not being closed (l. c., p. 265).

The genus *Cemiostoma* was divided by Stainton (Nat. Hist. Tin., i, 288) into two groups, one of which has the anterior wings of the perfect insect white, while the other has these wings leaden-gray. The former of these groups, to which our species belongs, contains six species, as far as known at present. These are *C. susinellum*, *spartifoliellum*, *wailesellum*, *coffeellum*, *labur-*

nellum and *zanclœellum*. *Cemiostoma coffeellum* is the only species of the genus yet known outside of the limits of Europe.

Our species may be known from the other species of the group by the following characters: *C. zanclœellum* has not the first golden band on the costa; in *C. susinellum* this band extends across the wing, reaching the inner angle; in *C. laburnellum*, *spartifoliellum* and *wailesellum*, this band hardly reaches to more than half the distance from the costa to the black spot, and the second band is bordered on *both* edges by dark scales. Further, all the species of the group, except possibly *C. zanclœellum*, have two or three fuscous streaks on the fringe, radiating from the black spot. I can discover no such streaks in this species.

I do not find it recorded that any other species of the group, except *C. laburnellum*, breeds more than once in a year. Stainton says (Nat. Hist. Tin., i, 314) that *C. laburnellum* breeds twice.

Seasons.—The larvæ are said to attack the new leaves in early spring, and to be found from that time forth. As the coffee-tree is evergreen, it seems likely that the period of hibernation is very short or none at all. Guérin says (Mém. etc., p. 16) that the insect occurs throughout the year in the Antilles, but is more or less abundant according to the seasons.

The eggs which I have mentioned were seen on the twenty-fifth of January. The planter who showed them to me said he had seen the moths that day. I found the larvæ, pupæ, and imagos from the ninth of March until my observations ended on the twenty-first of June.

Periodicity.—Guérin says (Mém. etc., pp. 17, 43) that the eggs hatch seven or eight days after being laid. The larvæ then live about fifteen or twenty days within the leaf, after which they make their cocoons. The cocoon is spun within less than twenty-four hours after the larva has left the mine. The larva-skin is thrown off within twenty-four hours after the cocoon is completed. I did not observe how long the pupa-state continues. According to Guérin (Mém. etc., p. 13, 17), the imago comes out of the cocoon at the end of six days. It is not known how long it lives. I should judge that it lived less than two weeks, as that has been noticed to be the probable limit of life in *C. scitellum* (Entom. Monthl. Mag., iv (1867), p. 162).

The history of reproduction, and of the deposition of eggs is not known. It must have an important effect upon the longevity of the sexes. Guérin says (Mém. etc., p. 17), that the insect is reproduced several times in the year, in the Antilles, once in about every forty to forty-eight days. This would allow for the Eggs, 7 to 8 days; Larva, 15 to 20 days; Pupation, 2 days; Pupa, 6 days; Imago, 10 to 12 days; total, 40 to 48 days.

Habits of the larva.—As soon as the larva is hatched (if I mistake not), it cuts through the upper epidermis of the leaf, and begins to eat the parenchyma. Usually it may be found under an edge or an end of the blotch, eating. I found no cast skins in the mines. The larvæ can not be considered social, although several are often found in one mine when several mines have become united. They show no signs of pugnacity or mutual destructiveness. When the larva is full-grown it escapes from the mine, and often, or even generally, goes to another leaf to make its cocoon. This it can do by letting itself drop with a thread of silk. It then makes its cocoon across one of the furrows at the edge of a leaf, on either the upper or the under surface, but oftener on the under surface. The larva places itself across the furrow, and begins a web by spinning a series of threads from one side to beyond the middle of the furrow, swinging the fore part of its body back and forth sidewise. When it has made one side of one end of its web thus, it spins a like series of threads to make the other side, without changing the position of the hind part of its body. Thus an opening is left in the middle of this end of the web, in the space occupied by the body of the larva. It then turns around, and places its body across the furrow in the opposite direction. Here it spins a like series of threads on each side of it, from the leaf to the former part of the web, leaving a similar opening in this end. It then retires beneath the web, and lays a flooring of silk. On this flooring it spins its cocoon, laying the outside threads lengthwise.

The cocoons are found in the greatest abundance on the leaves which are near the ground, and frequently on leaves which have never been injured.

Habits of the Pupa.— The larva-skin is split *longitudinally* over the middle line of the head and first two thoracic segments. The split extends from the very foremost extremity of the head to the third thoracic segment (*metathorax*), but does not enter this latter. For the certain observation of this fact, and of the manner in which the pupa-skin is burst, I am indebted to Dr. Hagen, who pointed out to me these interesting details. The skin is then thrown off and pushed out through the posterior end of the cocoon.

Habits of the Imago.—The pupa-skin is split transversely across the back of the head (*vertex*) then longitudinally along the sides of the thorax as far as the metathorax. When the imago emerges, the pupa-skin is left inside of the cocoon, generally I think, but in some cases I have found it protruding from the anterior end of the cocoon, through which the imago escapes by pushing aside the threads. It rests on or under the leaves or branches, but is easily disturbed. "It is very lively and very agile," as Guérin says (Mém. etc. p. 16) "and flies in all directions seeking to copulate. It is seen to execute rapid bounds, and its jerking flight makes it known even at a distance." It flies in the day-time, perhaps also in the night-time.

I judge from the appearance of the scars in the epidermis, already described, that the eggs are laid unconcealed on the upper surface of the leaf, singly, or in sets of two, three or more, but not in immediate proximity, and that sometimes two or more sets are placed on the same leaf. It is not known how many eggs are laid by one female.— *To be continued.*

EXPLANATION OF PLATE 5.

FIG. 1. Imago of *Cemiostoma coffeellum,* magnified 15 diameters.

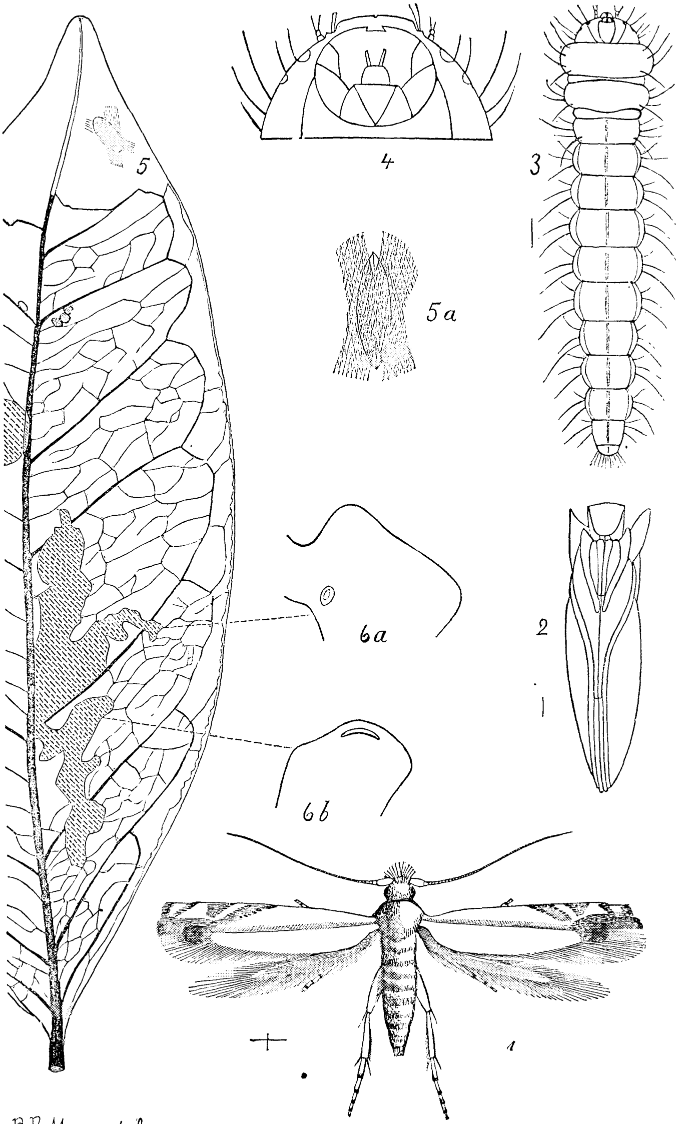
FIG. 2. Empty pupa-skin of the same, seen from beneath, magnified about 20 diameters. (The projections near the head are the broken sides of the thorax.)

FIG. 3. Larva of the same from above; the head retracted, magn. 15 diameters.

FIG. 4. Head of the larva from below, showing some of the mouth-parts, magnified about 60 diameters.

FIG. 5. Cocoon of the same, natural size; *5a*, the same magnified 3 diameters.

FIG. 6. Leaf of coffee tree natural size, containing five mines made by ten larvæ, five of the larvæ belonging in the four mines wholly figured; *6a*, part of a mine magnified 10 diameters to show the scar made by the larva in entering the leaf; *6b*, part of a mine magnified 5 diameters to show the slit made by the larva in leaving the mine.



B.P. Mann del.

MANN, ON THE WHITE COFFEE-LEAF MINER.